

DRAWINGS ATTACHED

1 202 528

(21) Application No. 48277/66 (22) Filed 27 Oct. 1966

(23) Complete Specification filed 9 Oct. 1967

(45) Complete Specification published 19 Aug. 1970

(51) International Classification B 66 c 23/06 E 02 f 9/20

(52) Index at acceptance

B8B 1A 1C2

E1F 22

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## (54) CONTROL SYSTEM FOR CIVIL ENGINEERING MACHINES

(71) We, PRIESTMAN BROTHERS LIMITED, a British Company, of Holderness Engineering Works, Heddon Road, Hull, Yorkshire, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

In traditional crawler mounted civil engineering machines, such as excavators and cranes, the operator is confronted with a row of five or six or even more levers each of which is moved to and fro to engage a different motion, such as taking in or paying out a hoist rope, travelling backwards and forwards, luffing a boom of the machine, or slewing the superstructure. The large number of control levers takes up a considerable amount of space in the operator's cabin and makes the rapid selection of the right lever to engage the appropriate motion difficult. The operator has to move his hands continually from one lever to another and as he only has two hands it is virtually impossible for him to manipulate more than two levers, and hence control more than two motions, simultaneously.

With the aim of eliminating these disadvantages we have designed an entirely new control system for a crawler mounted civil engineering machine involving a minimum number of control levers, in the form of joysticks, which are displaceable from an upright neutral position both forwards and backwards away from an imaginary central transverse plane, to select one motion in one sense or the other, and from side-to-side away from an imaginary central longitudinal plane, to select another motion in one sense or the other. Both motions can be selected to an appropriate extent by displacing the joystick at an intermediate angle away from both the imaginary planes so that the two adjacent primary motions are selected by an amount dependent upon the component of displacement of the joystick away from the corresponding plane. Ideally, only

two joysticks are provided, one for each of the operator's hands. If more than four motions are to be controlled, a selector switch will be provided so that a motion controlled by the to and fro displacement of the joysticks away from one plane can be converted from the control of one motion to the control of another motion which will not be required simultaneously with the first motion. In this way, as many as eight motions, and in practice this is more than is needed, can be accommodated, and any four motions which are likely to be required simultaneously can each be selected to the appropriate extent by manipulation of the two joysticks without the operator having to move his hands from them.

This improved control system requires built-in safety precautions to avoid the inadvertent production of a dangerous situation. Such a situation may arise for example if a common joystick controls both luffing of a boom of the machine and the taking in and paying out of a rope. The danger arises if the joystick is displaced to an intermediate position in which it partly selects both luffing up as well as the taking in of the rope, as if the operator is focussing on the load which is rising he may not realise that the boom is luffing up at the same time.

In accordance with the present invention, a control system of a civil engineering machine includes a joystick which is universally displaceable from a central upright neutral position, displacement of the joystick in one direction or the other away from a central vertical plane controlling a rope drum to pay out or take in the rope respectively and displacement of the joystick in one direction or the other away from a second central vertical plane, perpendicular to the first plane, causing luffing of a boom of the machine, displacement of the joystick away from the second plane being inoperative to cause luffing of the boom unless a spring loaded finger piece

[Price 5s. 0d. (25p)]

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- (71) We, PRIESTMAN BROTHERS LIMITED, a British Company, of Holderness Engineering Works, Heddon Road, Hull, Yorkshire, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—
- In traditional crawler mounted civil engineering machines, such as excavators and cranes, the operator is confronted with a row of five or six or even more levers each of which is moved to and fro to engage a different motion, such as taking in or paying out a hoist rope, travelling backwards and forwards, luffing a boom of the machine, or slewing the superstructure. The large number of control levers takes up a considerable amount of space in the operator's cabin and makes the rapid selection of the right lever to engage the appropriate motion difficult. The operator has to move his hands continually from one lever to another and as he only has two hands it is virtually impossible for him to manipulate more than two levers, and hence control more than two motions, simultaneously.
- With the aim of eliminating these disadvantages we have designed an entirely new control system for a crawler mounted civil engineering machine involving a minimum number of control levers, in the form of joysticks, which are displaceable from an upright neutral position both forwards and backwards away from an imaginary central transverse plane, to select one motion in one sense or the other, and from side-to-side away from an imaginary central longitudinal plane, to select another motion in one sense or the other. Both motions can be selected to an appropriate extent by displacing the joystick at an intermediate angle away from both the imaginary planes so that the two adjacent primary motions are selected by an amount dependent upon the component of displacement of the joystick away from the corresponding plane. Ideally, only two joysticks are provided, one for each of the operator's hands. If more than four motions are to be controlled, a selector switch will be provided so that a motion controlled by the to and fro displacement of the joysticks away from one plane can be converted from the control of one motion to the control of another motion which will not be required simultaneously with the first motion. In this way, as many as eight motions, and in practice this is more than is needed, can be accommodated, and any four motions which are likely to be required simultaneously can each be selected to the appropriate extent by manipulation of the two joysticks without the operator having to move his hands from them.
- This improved control system requires built-in safety precautions to avoid the inadvertent production of a dangerous situation. Such a situation may arise for example if a common joystick controls both luffing of a boom of the machine and the taking in and paying out of a rope. The danger arises if the joystick is displaced to an intermediate position in which it partly selects both luffing up as well as the taking in of the rope, as if the operator is focussing on the load which is rising he may not realise that the boom is luffing up at the same time.
- In accordance with the present invention, a control system of a civil engineering machine includes a joystick which is universally displaceable from a central upright neutral position, displacement of the joystick in one direction or the other away from a central vertical plane controlling a rope drum to pay out or take in the rope respectively and displacement of the joystick in one direction or the other away from a second central vertical plane, perpendicular to the first plane, causing luffing of a boom of the machine, displacement of the joystick away from the second plane being inoperative to cause luffing of the boom unless a spring loaded finger piece
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button in the upper end of the joystick 1, is capable of energising the valve 19 through a lead wire 23 from a lead wire and the source 12. When the switch 22 is closed the solenoid in the valve 19 moves the spool against its spring loading to the illustrated position in which the line 20 supplies air to the line 6. It is therefore necessary to depress the push button and close the switch 22 before the luffing rope drum, or if the selector switch 11 is closed the bridle rope drum, can be operated. If the selector switch 11 is closed, a warning lamp 25, mounted in the push button beneath a transparent cover of the push button, is energised through a lead wire 26 from the source 12. Thus the lamps 18 and 25 light together when the joystick is potentially capable of operating the bridle rope drum after closure of the switch 22.

Luffing cutout switches 27, 28 and 29 control the energisation of the switch 22, and hence the solenoid of the valve 19, when the selector 11 is in its first position selecting luffing control. The switches 27 and 28 are minimum and maximum radius cutouts for the boom and the switch 29 is operated by a gear change and is only closed when the gear change is in a low speed position. Opening of any one of the switches 27, 28 and 29 renders the joystick inoperative in controlling luffing of the boom.

#### WHAT WE CLAIM IS:—

1. A control system of a civil engineering machine, the control system having a joystick which is universally displaceable from a central upright neutral position, displacement of the joystick in one direction or the other away from a central vertical plane controlling a rope drum to pay out or take in the rope respectively and displacement of the joystick in one direction or the other away from a second central vertical

plane, perpendicular to the first plane, causing luffing of a boom of the machine, displacement of the joystick away from the second plane being inoperative to cause luffing of the boom unless a spring loaded finger piece mounted on a handle of the joystick is held depressed.

2. A system according to claim 1, in which the fingerpiece is a thumb button.

3. A system according to claim 1 or 2, in which the joystick carries a plate at its lower end overlying spring loaded plungers of four pneumatic valves which are equally spaced around the upright neutral axis of the joystick, two on each of the vertical planes, displacement of the joystick in an appropriate direction then depressing one or two of the plungers of the valves which then transmit an appropriate pneumatic signal to an appropriate clutch or clutches or brake drum or drums providing the direct control of the motion or motions selected.

4. A system according to claim 3, which is electro-pneumatic, and in which the finger piece is an electrical switch connected to an isolating solenoid valve which only energises the luffing valves when the finger piece is depressed, actuating the switch.

5. A system according to any one of the preceding claims, provided with a selector for converting displacement of the joystick away from the second vertical plane from controlling the luffing operation to controlling a second rope drum.

6. A system according to claim 1, substantially as described with reference to the accompanying drawings.

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